

training images from videos of a subject.

Thus, the applicants have claimed elements not taught in the cited art and which have advantages not recognized therein, namely the ability to **synthesize images of different face poses from a specific model of a subject and using these synthesized images to train a recognizer.** Accordingly, no prima facie case of obviousness has been established in accordance with the holding of *In Re Fine*. This lack of prima facie showing of obviousness means that the rejected claims are patentable under 35 USC 103 over Yan in view of Kung. It is, therefore, respectfully requested that the rejection of Claims 1-11 and 16 be reconsidered based on the novel claim language:

" A computer-implemented process for face recognition, comprising using a computer to perform the following process actions...inputting an image of a face of a subject sought to be recognized having a particular face pose; inputting a generic three dimensional face model; creating a specific three dimensional face model of the specific subject sought to be recognized by deforming the generic face model to conform to the shape of the face depicted in the input image; **synthesizing various face pose images using the specific 3-D face model; and employing the synthesized images as training images to train a recognizer.** " (emphasis added)

The 35 USC 103 Rejection of Claims 12-15.

Claims 12-15 were rejected under 35 USC 103(a) as unpatentable over Yan, in view of Kung, and in further view of Deering, U.S. Patent No. 6,525,723, hereinafter Deering. The Examiner stated that Yan and Kung do not teach assigning the color intensity of each

pixel in order to perform textural analysis. However, the Examiner contended that Deering teaches this feature. The Examiner further contended it would have been obvious to have modified the Yan and Kung systems by Deering's color intensity calculations. The applicants respectfully traverse this contention of obviousness.

The applicants' claimed invention allows for face recognition even in the absence of a significant amount of training data. Further, it can recognize faces at various pose angles even without actual training images exhibiting the corresponding pose. This is accomplished by synthesizing training images depicting a subject's face at a variety of poses from a small number of actual images of the subject's face and using these synthesized images to train a recognizer.

Neither Yan, Kung, nor Deering disclose a system and method that allows the training of a recognition system by employing at least one image to generate a synthesized training database. Nor does Yan in combination with Kung and Deering recognize the advantages of the applicants' claimed invention. Namely, namely neither Yan, Kung, nor Deering, alone or in combination, teach the applicants' claimed system and method of face recognition using a training database made of synthesized images.

Granted, the Examiner states that Yan teaches this feature at page 857, col. 2, lines 17-32 which state,

"This paper aims at the following two aspects... 1. Based on the multi-direction images pre-provided by the animator, we proposed a general method for manipulating polygonal mesh of human face model, which deform the current face model to get a new face model by specifying the new 3-D positions of a set of specific vertexes (feature points). When move a vertex to match the specific feature point in the image, the deformation algorithm automatically calculate the new position of the relative vertex around the moved vertex. This simulate the plastic-

visco-elastic behavior of the facial skin. 2. Multi-direction texture mapping technique is developed to further enhance the realism of the synthesized human face. We designed an algorithm to select texture information from the frontal view and profile view images of the specific subject's face."

However, this cited passage is just an overview of Yan's process of generating different facial expressions by moving vertices of a face model. **No mention is made in this passage, or the rest of the Yan reference, of generating a set of synthesized images to train a recognizer.**

Thus, the applicants have claimed elements not taught in the cited art and which have advantages not recognized therein. Accordingly, no prima facie case of obviousness has been established in accordance with the holding of *In Re Fine*. This lack of prima facie showing of obviousness means that the rejected claims are patentable under 35 USC 103 over Yan in combination with Kung and Deering. As such, it is respectfully requested that the rejection of Claims 12-15 be reconsidered based on the above-quoted claim language.

The 35 USC 103 Rejection of Claim 17.

Claim 17 was rejected under 35 USC 103(a) as unpatentable over Yan, in view of Kung and in further view of Georghiades, June 1999. The Examiner stated that Yan and Kung do not teach varying illumination to produce synthesized images. However, the Examiner contended that Georghiades teaches this feature. The Examiner further contended it would have been obvious to have modified the Yan and Kung systems by Georghiades' teachings. The applicants respectfully traverse this contention of obviousness.

As discussed previously, the applicants' claimed invention allows for face

recognition even in the absence of a significant amount of training data. Further, it can recognize faces at various pose angles even without actual training images exhibiting the corresponding pose. This is accomplished by synthesizing training images depicting a subject's face at a variety of poses from a small number of actual images of the subject's face. These synthesized images are used to train a recognizer.

Georghiades teaches an illumination-based method for synthesizing images that does not require any knowledge of light source directions or the establishment of point or line correspondences. However, like Yan and Kung, **Georghiades does not disclose a system and method that allows the training of a recognition system to recognize a person based on a synthesized database.**

Therefore, Yan, Kung, nor Georghiades, alone or in combination, **do not disclose a system and method that allows the training of a recognition system to recognize a person based on a synthesized database.** Nor does Yan in combination with Kung and Georghiades recognize the advantages of the applicants' claimed invention. Namely, namely neither Yan, Kung, nor Georghiades, alone or in combination, teach the applicants' claimed system and method of face recognition using a training database made of synthesized images generated from as little as one image.

Thus, the applicants have claimed elements not taught in the cited art and which have advantages not recognized therein. Accordingly, no prima facie case of obviousness has been established in accordance with the holding of *In Re Fine*. This lack of prima facie showing of obviousness means that the rejected claim is patentable under 35 USC 103 over Yan in combination with Kung and Georghiades. As such, it is respectfully requested that the rejection of Claim 17 be reconsidered based on the above-quoted claim language.